

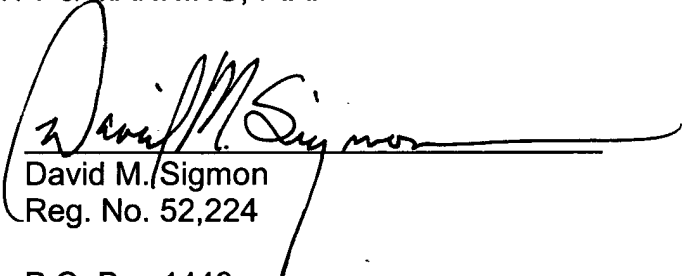
## **REMARKS**

With this present amendment, please find the Certified Priority Document. The present amendment will greatly facilitate prosecution of the application. The new claims more distinctly set forth and claim the invention. The Examiner is encouraged to contact the undersigned to resolve any issues regarding this matter.

Respectfully submitted,

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## **PATENT APPLICATION**

**ATTORNEY DOCKET NO.: S&S-1202a**

### **TITLE OF THE INVENTION**

**FRICTION RING FOR A FRICTION ROLL FOR THE  
DRIVING OF A SPOOL ON A TEXTILE MACHINE**

### **BACKGROUND OF THE INVENTION**

The present invention concerns a friction ring for a friction roll for friction drive as well as partial shape contact drive of a spool on a textile machine in accord with the principal concept of claim 1.

A known (EP 0 573 953 B1) friction roll having a friction ring, for driving a spool, possesses more than one, possibly three, adjacently situated, individual roll bodies placed on a common shaft. In this case, the centermost of these roll bodies is rotatably affixed to the ~~said~~ common shaft and coupled by a drive to two axially disposed friction rolls, one at each end. Each of these two outer, roll bodies possess on their respective outer circumferential surface a friction ring to improve the drive of the ~~said~~ spool. With this friction roll arrangement, a possible replacement of a friction ring, because of wear, or other deterioration, necessitates the replacement of the entire friction roll assembly. This is a very costly and labor intensive operation, especially for a textile machine with a multiplicity of adjacent spool locations.

### **SUMMARY OF THE INVENTION**

~~The~~ A principal purpose of the invention, accordingly, is to create a friction ring for a friction roll, which, in case of need, can be exchanged without

disassembly and assembly of the friction roll and so exchanged in a simple and time saving manner. Additional features and advantages of the invention will be set forth in part in the following description, or may be obvious from the description, or may be learned through practice of the invention.

The stated purpose is achieved by the friction ring being designed as a belt with two open ends, which are bound together by means of a fastening apparatus ~~the features of claim 1.~~ By means of the invented design of the friction rings as finite strips, the ends of which are bound together, the friction ring, in a case of wear, can be quickly exchanged in a simple manner by the release of a connector at the ring ends, or even by the destruction of the ~~said~~ friction ring. In this way, the friction roll in its entirety, or the shaft which carries the friction roll, need not be dismounted or exchanged.

The fastening apparatus which serves for the binding of the two ends of the striplike, engirdling friction ring can be constructed in various ways. In accord with an advantageous embodiment ~~of the object of the invention, as is found in claim 2,~~ the ~~said~~ fastening apparatus can assume, simultaneously, the function of an attachment to the roll.

Such a fastening apparatus can also be designed in various ways, for instance, as a clip-element, which can function as a clip in a correspondingly prepared recess. This configuration is shown as particularly advantageous as a fastening agent, ~~as taught in claim 3 or claim 4.~~

It is possible to affix the friction ring of the invented friction roll ~~in accord with claim 5,~~ ~~independently~~ independent of the connection itself onto the underlying

roll. Such design is particularly of value, if, because of the thickness and/or the width of the friction ring, it becomes difficult to fit this onto the roll with such a characteristic pretensioning, that the friction ring seats itself thereon securely and slip-free. In this operation, it is ~~of advantage~~, advantageous to apportion the connection and the additional affixing agents as equally ~~in accord with claim 6~~ as possible around the circumference of the friction roll.

Advantageously, the connection, ~~in accord with claim 7~~ for each of the two ends of the encompassing friction ring, possesses a separate, nonreleaseable fastening apparatus, which is bound to the respective ends of the friction ring. In this arrangement, ~~in accord with claim 8~~, both ends of the fastening apparatus, which apparatus is specific to the friction ring, first, ~~serves~~ serve for the connection of the two ends of the friction ring, and second, ~~provides~~ provide the fastening of the beltlike friction ring onto its roll.

Advantageously, the connections ~~in accord with claim 9~~ are designed as clip-elements, since in this way, it becomes possible to open and shut the binding elements in a simple manner and, as a rule, without accessory tools. This is of ~~advantage~~ advantageous in achieving a rapid exchange of the friction ring.

In the case of another advantageous design ~~of the object of the present invention, following claim 10~~, the two coacting fastening devices are designed to be in the shape of hooks. In a preferred development of the invented friction roll, ~~as found in claim 11~~, ~~provision~~ provisions can be made so that the hooks at the connection area are built with tapered surfaces, which, first, ~~eases~~ ease the opening and closing of the connection between the two ends of the friction ring

and, second, ~~assures~~ assure that even in the case of the spool, which, during operation lies against the friction roll, is always afforded a uniform, secure connection between the two friction ring ends.

Upon the braking of the spool in the circumferential direction of the friction roll, the ~~said~~ connection is subjected to a particularly severe force. In order to assure the spool of a faultless closure of the friction ring, and to make the assurance ~~independently~~ independent of the size and the ~~thereto~~ related inertia to be braked, an embodiment of the invented friction roll ~~in accord with claim 12~~ where the two hooks are subjected to a load in their locking direction relative to the direction of drive of the friction ring is particularly of advantage.

The two connectors can be bound to the respective ends of the encompassing friction ring in various ways. This connection can be made, for example, by the application of an adhesive placed on two concentric, slightly raised surfaces on the roll as well as onto the friction ring, whereby a shape-fit connection between the ends of the friction ring and the connection element ~~as noted in claim 13~~ is effected very satisfactorily.

Instead of a situation, in which the friction ring, solely or with the aid of additional ~~of~~ fastenings is secured on the roll, another advantageous improvement of the invented apparatus ~~in accord with claim 14~~ allows ~~provision~~ provisions to be made so that the elastically designed friction ring lies stressed, subjected to a predetermined tension on the roll, to such an extent, that auxiliary fastening elements can be dispensed with. In this way, a non-uniform cross-sectional shape ~~in the manner of claim 15~~ can be made, or a differently running

breadth of the friction ring ~~in accord with claim 16~~ can be provided.

Advantageously, the tapered shaping of a cross-section of this kind or variation of width ~~design in accord with claim 17~~ could be predetermined. This predetermination would be advantageous for the behavior of the tensioning of a friction ring for installation over the circumference of a roll.

In accord with yet another advantageous embodiment ~~of the object of the invention in accord with claim 18~~, it is possible that a deformation of the friction ring and/or the connection element, be accounted for. Such action would greatly ease the placement of the friction ring on the roll.

If the two free ends of the friction ring adhere together by adhesive, then a particularly firm connection is obtained. Upon the removal of a worn out ring, this connection would be destroyed.

If the two free ends of the friction ring possess previously prepared locations for adhesive, then the mounting can be carried out very rapidly and reliably. Preparatory work with adhesives during a mounting procedure should be avoided. This avoidance at a work site enables a defined and durable adhesion of different friction rings.

If the prepared adhesion location points are covered before the connection, then the ~~said~~ adhesion location, as well as the adhesive, are protected from contamination and damage.

If the ~~said~~ predetermined adhesion points are activated by light or heat, then, following a proper positioning of the friction ring, the adherence can be

executed in a very reliable manner, since an activating light or heat source can be brought into the proximity of the connection location.

A friction ring, made in accord with the invention, allows, in a simple way, an economical and time saving exchange of the friction ring, without the necessity of a complete disassembly of the friction roll which bears the ~~said~~ friction ring. It is not required, to temporarily disassemble the shaft, which carries the spool locations adjacent to the friction rolls, to make an exchange of the friction ring of one or more friction rolls. Because of the achievable gain in time savings, with the aid of the ~~invented object~~ invention, the time expenditure essentially diminishes itself for this friction ring change. Where textile machines with a multitude of adjacent spool stations are concerned, this saving is of considerable importance.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

Embodiment examples of the invention are explained in greater detail with the aid of drawings. ~~There is shown in:~~

Fig. 1 shows an invented friction roll in perspective view;

Fig. 2 shows an invented friction ring for a friction roll;

Fig. 3 shows an invented fastening apparatus for the two ends of the friction ring of Fig. 2;

Figs. 4 ~~to~~ 5, and 6 show securement devices designed as fastening apparatuses shown in cross-section; and

Fig. 7 shows a detail of the invented friction ring shown in perspective.

## **DETAILED DESCRIPTION**

Reference will now be made in detail to the presently preferred embodiments of the invention, one or more examples of which are shown in the figures. Each example is provided to explain the invention, and not as a limitation of the invention. In fact, features illustrated or described as part of one embodiment can be used with another embodiment to yield still a further embodiment. It is intended that the present invention cover such modifications and variations.

In Fig. 1, a friction roll 1 is illustrated ~~a friction roll 1~~ for the contact driving of a spool S on a textile machine. This friction roll 1 is driven by a shaft 14, which, for itself, is bearingly supported ~~to rotate~~ for rotation in holders 13. The shaft 14 extends itself through a plurality of neighboring spool positions. Each spool station is served by one friction roll 1.

The illustrated friction roll 1 is comprised of three roll bodies 10, 11, 12, which are axially aligned with one another. Of these three, the mid-roll body 11 is driven by the shaft 14.

The two outer roll bodies 10, 12, through a differential drive, are actuated by the ~~said~~ mid-roll body, so that these outer roll bodies 10, 12 can turn with different speeds of rotation allowing a conical spool S to be driven by them. Since the middle roll body 11 does not contribute to the drive of the conical spool S, only the outer roll bodies are equipped with a friction ring 2. The middle roll body 11 serves mainly for the support of the spool S.



The radius  $r_1$  (Figs. 4 to 5 and 6) of the two outer roll bodies 10, 12 in the immediate proximity to the middle roll body, is slightly less than its radius  $r_2$ . On this account, the friction rings 2 on the two outer roll bodies, because of the difference of the radii  $r_1$  and  $r_2$  are secured from axial displacement. For the axial security of the friction ring 2, on their sides remote from the middle roll body 11, the two outer roll bodies 10, 12, respectively, carry a retainer ring 100, 120 on their end proximal to the friction ring 2, ~~retainer ring 100, 120~~.

Generally, the friction rings 2 of the two roll bodies 10, 12 in the illustrated embodiment are essentially equally constructed, on which account, in the following description, reference will be made to only one friction ring 2.

A friction ring 2, of the kind shown in Fig. 2, drives the spool by frictional as well as a partial shape based contact. To this end, the friction ring 2 possesses on its outer circumference, or outer side, a surface-roughness, the character is of which is due to a corresponding choice of material, its shaping, or surface working. The friction ring 2 is a kind of belt or girdle made with two free ends 20, 21, which said ends, with the aid of a fastening apparatus 3, can be releasably or durably bound to one another. After bringing together the two ends 20, 21, the device assumes its ring shape.

The fastening apparatus 3 is composed of two self engaging connectors 30, 31. Connector 30 binds with the end 20 and the connector 31 binds with the end 21 of the friction ring 2. This binding may be optionally releasable or non-releasable, but principally the type of release or non-release of such a binding is not particularly important.

An embodiment of an advantageous fastening apparatus 3 is described below with the aid of Fig. 3. Each of the two connectors 30, 31 have, in this matter, a fastening area 300, 310, which overlap the assigned ends 20, 21 of the friction ring 2 in areas  $l_1, l_2$ . So that the friction ring 2, over its entire length, exhibits a constant thickness, each end 20, 21 possesses for the receipt of the connection area 300, 310 of the two connectors 30, 31 an appropriately dimensioned recess 200, 210 (see Figs. 2 and 4). In this arrangement, ~~provision~~ provisions ~~has~~ have been made, so that the two ends 20, 21 of the friction ring 2 find themselves on the outside ~~of the~~ of the friction ring 2 when this assumes its closed, ring-shaped condition. In this way, the designed outside surface 23 of the friction ring 2, which surface provides the friction action, extends itself to the extreme end areas 201, 211 as seen in Fig. 4.

In regard to the constructive form of the fastening apparatus of friction ring 2 as shown in Fig. 3, this form, in its area 300, 310 has a profiling, with the aid of which the connectors 30, 31 bind themselves not only in force fit, but also in shape closure, with the ends 20, 21 of the friction ring 2. Thus, the two connectors 30, 31, as seen in Fig. 3, have, in their fastening areas 300, 310, two pairs of cuplike recesses 301, 302 and 311, 312 into which complementary cuplike projections 202, 212 (see Fig. 4) of the ends 20, 21 of the friction ring 2 impinge. Further, there is provided in each connector 30, 31 a transverse groove 303, 313 for the reception and the securement of the extreme end 201, 211 of the ends 20, 21 of the friction ring 2.

The two connectors 30, 31 as seen in Figs. 2 and 3, are respectively hook form in design, and again respectively, possess a recess 304, 314 for engagement with a hook 305, 315 of a complementary connector. The longitudinally, elastically designed friction ring 2 has, in this arrangement, such a length that it can lie under tension in its locked condition, with the aid of the fastening apparatus 3, around the roll body 10, 12 without danger of displacement.

If, as a result of abrasion, or because of some other reason, a friction ring 2 of a friction roll 1 must be exchanged, then this can take place without a preliminary dismantling of the said friction roll 1. By sliding together the two connectors 30, 31, the two hooks 305, 315 move into a zone, in which they may be separated by means of a radial lifting of the hook 305, for example, from the recess 314.

The opened friction ring 2 can now be swung open to such an extent that, without difficulty, the said ring can be taken off of the roll body 10, 12.

In an analogous manner, it is possible that a new friction ring 2 can be fitted onto the roll body 10, 12, to which that said ring may be assigned. The two ends 20, 21 of the friction ring 2 are held at such a separating distance, one from the other, that the opened friction ring 2 can be slipped over the roll body 10, 12. When that is accomplished, then the two connectors 30, 31, found on the ends of the friction ring 2 can be drawn close to one another by pulling on the involved ring. This pulling, or tensioning, which takes place in a radial direction remote from the friction roll carrying shaft 14, is increased until the two hooks 305, 315

engage in the respective recesses 304, 314. At the moment of engagement, the said hooks and recesses lock into one another and a common buckling of the two ends of the friction ring 2 has been achieved.

In order to ease the in and out engagement of the two hooks 305, 315 of the respective connectors 30, 31 during the closure and opening operation, as seen in Figs. 2 and 3, ~~provision~~ provisions ~~is~~ are made in the illustrated embodiment, so that the backs 306, 316 of the hooks 305, 315 are tapered for smooth operation. For the binding of the two connectors 30, 31, these said connectors are caused to meet together, whereby the two hooks 305, 315, in conjunction with their backs 306, 316 slide into one another until the said hooks and backs come to full engagement within the recesses 304, 314.

To simplify the separation/opening movements concerning the two connectors 30, 31, at the engagement of the joining hooks 305, 315, the wall 308 of the recess 304, which lies facing the back 316 of the hook 315, is contoured appropriately to the said movement. During the opening operation of the two connectors 30, 31, when fastening apparatus 3 is closed, the hook 315 is lying on the outer circumferential surface 17 (Figs. 4 to 6) of the roll body 10, 12. The back 316 of ~~said~~ the hook 315 then slides upward against the wall 308, thereby lifting hook 305 out of its complementarily dimensioned recess 314.

In the Figs. 1 and 3, the drive direction  $f_1$  of the friction roll 1 is presented ~~the drive direction  $f_1$  of the friction roll 1~~ during the corresponding drive of the spool S in its normal windup direction  $f_2$ .

When these drives are in effect, the two connectors 30, 31 are ~~so~~ located so that the spool S, during its drive by the friction roll 1, holds the two hooks 305, 315 in a countersided grip.

This is also the case, if, during the drive of the friction roll 1, the connector 31, which rotationally precedes in relation to the drive direction  $f_1$ , lies in its area ~~which~~ that contains the hooks 305, 315 on the circumferential surface 17 (Fig. 4 to 6) of the roll body 10, 12. During the acceleration of the spool S, this spool presses the hooks 305, 315 into a counter grip. Nothing in this force disposition is changed, when the spool S reaches the same circumferential speed as that of the friction roll 1. The hooks 305, 315 are thus loaded in their locking direction because of the drive direction  $f_1$  of the friction roll 1.

The connection between the two ends 20, 21 of the friction ring 2 can be carried out in different ways. For example, one of the elements 30, 31 ~~has~~ may have a boring (not shown) or a groove, which extends itself parallel to the roll body 10, 12 (likewise, not shown). With ~~this said~~ the groove, a correspondingly designed pin or web, or yet a bar, constructed in an appropriate manner, can be made to engage therein. Further, by means of a flexible construction of the ~~said~~ bar or pin, or a boring complementary thereto, the ~~said~~ groove can receive the bar or pin to make a kind of cliplike connection, which can be opened.

If, in the case of such a cliplike fastening apparatus, the friction ring 2 must be replaced, then it suffices, by means of exerting a pulling motion, which is oriented radially to the roll body 10, 12, to release the clip connection between the pin or its equivalent and the roll body 10, 44 12. After the removal of this ~~said~~

pin or its equivalent, the ends 20, 21 of the friction ring 2 are freed, so that ~~this~~ said the friction ring 2 can be removed from the roll body 10, 12 in the manner described above.

After the installation of the friction ring 2 on the roll body 10, 12, which is carried out as previously described, the clip connection, with the aid of the pin or its equivalent, can be once again replaced in its former position by means of the reinsertion of the pin or its equivalent in the said boring or groove.

The present invention is not limited to the described embodiments, but can be altered in multitudinous ways, especially by the substitution of features with equivalent features or by different combinations of features or their equivalents. In Fig. 4, with the same design of the friction ring 2 and its ends 20, 21, a fastening apparatus 9 is shown, which simultaneously is designed as fastening apparatus 4.

This, fastening apparatus 9, which is here principally shown in a schematic manner, possesses two binding connectors 90, 91 having longitudinal extensions 900, 910. The extensions 900, 910, which together serve for the fastening of the two connectors 90, 91 to each other, as well as fastening areas 901, 911, which areas are overlapped by the proximal ends 20, 21 of the friction ring 2 and, in a particular manner, these are releasable. That is to say, they are releasable with the aid of one or more bolts (not shown), or they may be non-releasable, i.e., bound together by adhesive. Seen radially, the outer longitudinal area 910 of the connector 91 possesses a smooth boring 912. Also, in the inner radial direction of longitudinal area 900 is a threaded boring 902 for the acceptance of a bolt 40,

which, first, extends itself into a part of the fastening apparatus 9, and second, is a part of the fastening apparatus 4.

As illustrated in the embodiment shown in Fig. 4, the fastening element depicted as a bolt 40 extends itself only into an internally threaded boring 902, thereby ~~p-trating~~ penetrating through extended section 910 into an underlying, extended section 900 of connector 90. However, it is still possible – again as seen in Fig. 4 by dotted line – that the boring in the ~~said~~ inner area 900 may be without an internal thread. In that latter case, the bolt 40 can penetrate both overlapping connectors 90, 91 to enter into an internally threaded continuation 101 of the boring in the roll body 10, 12. In this way, the friction ring 2 is secured, not predominately by its tension due to stretch around the roll body 10, 12, but also additionally by the bolt 40.

Further, by such a construction, the friction ring 2 can allow exchange without dismantling and remounting of the friction roll 1. It suffices, in this case, simply to loosen the bolt, in order to remove the friction ring 2 from the roll body 10, 12. The lifting away of the friction ring 2 is carried out in an analogous manner, as ~~this was done with the aids~~ as described in connection with Figs. 2 and 3. The only difference would be, that instead of the interlocked hooks of the connectors 30, 31, in this case the connection is made by means of a bolt 40.

If the fastening apparatus 4 is not constructed as a bolt 40, but as a clip-element, then the recess 101 would be designed in a manner corresponding to the demands of the ~~said~~ clip-element.

If, for the fastening and securement of the friction ring 2 on the roll body 10, 12, a fastening apparatus 4 is provided, it is possible that a separate fastening apparatus ~~such as~~ 3, 9 could be omitted. In this case, with the help of fastening apparatus 4, the two open ends 20, 21 of the friction ring 2 can be directly affixed to roll body 10, 12 without intermediate employment of such fastening apparatuses as 3, or 9. This direct fastening is carried out in various ways. For example, the two ends 20, 21 of the friction ring 2 can overlap themselves (see Fig. 4). With this overlap construction for these ends 20 and 21, ~~provision~~ provisions ~~has~~ have been made so that the thickness  $s$ , which equals the thickness of the friction ring 2 outside of the overlapping zone, is also maintained within this overlapping zone. Alternatively, ~~provision~~ provisions can be made, so that the ends 20, 21 of the friction ring 2 can be brought to a side to side surface connection, or in a more exact case, allow a negligible space between them, whereby both ends 20, 21 are each fastened by a separate securing apparatus 4 onto the roll body 10, 12.

If the friction roller 1 serves for the drive of a cylindrical spool S, then, in an axial direction, it is possible that a longer roll body length can be allowed for the drive of the ~~said~~ spool S. In accord with this, the friction ring 2 could be made to have a greater width. If this friction ring 2 were to be made elastic, as in the case of the construction described above, which would be especially favorable also for the drive of a conical spool, then a large force would be necessary, in order to stretch the friction ring 2 so far in a circumferential direction, that the two



connection elements 30, 31 could be linked together with their interlocking hooks 305, 315.

As a rule, it is ~~of advantage~~ advantageous if the friction ring 2 is held free of stress, or is placed on the friction roll 1 with a minimum of tension and can then be secured with the aid of a fastening apparatus 4 in the area of the ends 20, 21 of the ~~said~~ friction ring 2. In this way, ~~provision~~ provisions can be made ~~that~~ for the friction ring 2 ~~can~~ to be affixed to the friction roll 1 at a distance from this fastening apparatus 4, that is to say, affixed at a different position ~~of~~ on the circumference of the friction roll 1, with the aid of one or more additional fastening means 80, 81 (see Fig. 2).

For the achievement of a uniform contact of the friction ring 2 on the roll body 10, 12, the fastening apparatus 4, as well as the additional fastening means 80, 81 are placed with positional apportionment as equal as possible over the circumference of the roll body 10, 12.

Since, in Fig. 1, two of these kinds of fastening means 80, 81 are shown, it is obviously understood, that principally, a single, additionally added, fixation apparatus, placed essentially opposite to the fastening apparatus 4 should be sufficient. It is also possible, that even more than two additional fixation means 80, 81 can be so applied.

Fig. 5 shows a fastening apparatus 5, which operates on a different basis than does the fastening apparatus illustrated in Fig. 4. The friction ring 6 possesses, in accord with this embodiment, on its outer surface 62 remote from the roll body 10, 12, and at its two ends 60, 61, ~~a-recess~~ recesses 600, 610, into

which respectively extends a holding ~~surface~~ surfaces 50, 51 of the fastening apparatus 5. The two holding surfaces 50, 51 as well as the ends 60, 61 of the friction ring 6 are so dimensioned, that they, together, have essentially the same thickness  $s$  as the remaining stretch of the friction ring 6. The holding surfaces 50, 51 are a part of a support bar 52, which abuts on the outer circumferential surface 17 of the roll body 10, 12. In this case, the thickness  $s_1$  of the support bar 52, between the holding surfaces 50, 51 is slightly less than the thickness  $s_2$  of the ends 60, 61 of the friction ring 6. As a consequence thereof, the ends 60, 61 of the friction ring 6 ~~clamp~~ are clamped in between the holding surfaces 50, 51 of the fastening apparatus 5 and the roll body 10, 12, and are fixed in place by this clamping.

The roll body 10, 12 possesses a T-shaped, groove 15, parallel to the axis, in which the fastening apparatus 5 can fit with a complementary T shaped projection 53. The fastening apparatus 5 is thus securely held in the radial direction because of the back cutting of the T-shaped groove in the roll body 10, 12.

If the separating distance between the friction roll 1 and the holder 13 is of sufficient size, then the friction ring 6, when in its open condition, is outside of the longitudinal area of the friction roll 1, that is, the friction ring 6 will be between the friction roll 1 and the holder 13, wrapped about the shaft 14 (see Fig. 1). In this location, the two ends 60, 61 of the friction ring 6 approach one another, whereupon the fastening apparatus 5 is brought in between these two ends, in such a manner, that the two holding surfaces 50, 51 and the ends 60, 61 overlap

one another. The holding surfaces 50, 51 are now, in a conventional manner, releasably joined with the two ends 60, 61 of the friction ring 6.

The friction ring 6 now forms, with the fastening apparatus 5, a ring, and in this form is slipped onto the roll body 10, 12 in an axial direction, whereby, at the same time, the T-shaped projection 53 can be inserted into the complementary T-shaped groove 15 of the roll body 10, 12. In order to make this insertion movement possible from the outside of the friction roll 1, the end ring 100, 120 is removed. Alternatively, the said end ring 100, 120 can be temporarily taken away from the friction roll 1 in a radial direction for the duration of this axial movement of the T-shaped projection 53, upon the in/out placement of the friction ring 6. If no end ring 100, 120, designed for the axial retaining of the friction ring 6 on the roll body 10, 12, is in place, ~~provision~~ provisions can be made so that the fastening apparatus 5 is assigned yet another element, which assures that the friction ring 6 cannot be moved in an axial direction. Such an element can be designed, for example, as a bolt, similar to the bolt 40 described in connection with Fig. 4. In ~~this~~ the case of Fig. 5, the ~~said~~ bolt (not shown) would extend itself through the fastening apparatus 5 into an internally threaded boring in the roll body 10, 12.

If the space beside the friction roll 1 is not sufficient in size, then the retaining of the end rings 100, 120 can be alternately provided for, in such a way that the difference between the radius  $r_2$  of the roll body 11 and the radius  $r_3$  on the underside of the T-shaped, back cut groove 15 of the roll body 10, 12 is so dimensioned, that the friction ring 6, which has been installed in the middle

longitudinal roll body 11 can be closed with the aid of the fastening apparatus 5, ~~so that this.~~ This friction ring 6, analogous to the previously described method, can be slipped along the roll body 10, 12 in the axial direction, up to the abutment of the end ring 100, 120 simultaneously with the insertion of the T-shaped projection 53 into the groove 15 of the roll body 10, 12. A safety measure to avoid the axial sliding of the friction ring 6 in the direction of the middle of the friction roll 1 can be carried out by appropriate means in a similar manner as has been previously described.

A further embodiment of the friction ring 7 as well as a fastening apparatus 8 is shown in Fig. 6. The ends 70, 71 of the friction ring 7 possess in this example, a trapezoidal projection 700, 710, the adjacent end surfaces of which, in the closed position of the friction ring 7, come into binding contact.

Corresponding to the trapezoidal construction of the projections 700, 710, there is provided in the roll body 10, 12 a swallowtail recess 16 into which the complementary trapezoidal projection 700, 710 is accommodated. This combination of swallowtail recess and trapezoidal projection linkage extends itself over the entire width of the friction ring 7 in its operational position on the roll body 10, 12. The recess 16 forms in this construction, not only a fastening apparatus 8 for the friction ring 7, but also a connection means for the ends 70, 71 of the ~~said friction ring 7, because this.~~ This ring is held by the ~~said~~ recess 16 in a double sided grip, so that the friction ring 7 can extend itself over the entire circumference of the roll body 10, 12.

Even in this case, after the two ends 70, 71 have been laid, one upon the ~~another~~ other, the friction ring 7 is installed by means of axial sliding on the roll body 10, 12 during the simultaneous insert of the trapezoidal projection 700, 710 into the recess 16, ~~whereby~~. In such embodiments, an additional security ~~counter to measure against~~ axial movement can be ~~allowed for~~ installed, in particular, in the form of a bolt (see Fig. 4) in each of the ends 70, 71 or, ~~independently~~ independent of these ends 70, 71 or even in the form of a ring 100, 120 as seen in Fig. 1.

Obviously, the groove, or recess, 16 can also be cut back in a shape, which is aberrant from the swallowtail mode, such as the recess in Fig. 5, wherein the projections 700, 710 of the ends 70, 71 of the friction ring 7 would then have a shape which would conform to altered recess 16.

To facilitate the insertion of the friction ring 6, 7 (see Figs. 5 and 6) into the groove 15, 16, in such ~~construction~~ constructions, it is possible that the friction ring 6, 7 can be slipped onto the roll body 10, 12 free from stress or principally only under small tensioning. In this case, the friction ring 6, 7 is secured in its location by the fastening apparatus 5, 8 in the area of the ends 60, 61 or 70, 71.

Even when an axial fixation for the friction ring 6, 7 is attained, with the help of an end ring 100, 120 (Fig. 1), then, independently of the fastening apparatus 5, 8, additional fastening apparatuses 80, 81 (see Figs. 1, 2) can be provided.

The fastening apparatus 5, 8, serves not only for the fastening of the two ends 60, 61 and 70, 71 of the friction ring 6, 7, but also forms, in the case of these embodiments, a connection device. On this ground, it is possible, that

when the friction ring 2, 6, 7 in the area of its two ends, respectively 20, 21 and 60, 61, and 70, 71, is secured by a fastening apparatus 4, 5, 8 directly on the roll body 10, 12, a separate fastening means can be dispensed with.

Independently thereof, as to whether or not the friction ring 2, 6, 7 has been installed and secured on the friction roll 1 or on its roll body 10, 12, this a certain deformation can be exhibit a certain deformation exhibited. That is to say, the inside circumferential surface 22, 63 or 72 (Figs. 2, 5, 6) of the friction ring 2, 6, 7 can experience a curvature, which to a considerable measure reproduces the curvature of the outside circumferential curvature 17 of the friction roll 1, i.e., the curvature of the roll body 10, 12 of the friction roll 1. The same is true of the connectors 30, 31 or 90, 91 of the fastening apparatus 3, 9. The inner circumferential surface 307, 317 and 903, 913 can exhibit the same contouring, which principally represents the circumferential curvature of the outside circumference surface 17 of the friction roll 1 or its roll body 10, 12. In this way, it becomes possible, with the exertion of a minimum application of force, to bring the friction ring 2, 6, 7 into the desired end position, which is to be assumed on the roll body 10, 12.

Upon the extending of the friction ring 2, 6, 7, the occurrence is possible ~~that~~ with the material chosen therefor, that the friction ring 2, 6, 7 stretches beyond its specified width in different ways. Consideration can be given to the fact that the friction ring 2, 6, 7 in its untensioned condition, has a corresponding, proper continuity of cross-section in which the friction ring 2, 6, 7 is designed to be thicker along its axial centerline (see thickness  $s_3$  in Fig. 7) than it is along its

edges (see thickness  $s_4$ ), whereby the diminution of the cross-section from the thickness  $s_3$  to the thickness  $s_4$  runs in an even, gradual curvature.

The diminution of the ~~cross-section~~ sectional of the untensioned friction ring 2, 6, 7 from its maximum thickness  $s_3$  in the center of the friction ring 2, 6, 7 to its minimum thickness  $s_4$  at the edge areas is so adjusted to the tensioning of the friction ring 2, 6, 7 installed around the roll body 10, 12, that essentially the difference between the thickness  $s_3$  in the center of the friction ring 2, 6, 7 and the thickness  $s_4$  in the two edge areas, of the ~~said~~ friction ring 2, 6, 7 disappears, that is to say, the cross-section of the friction ring 2, 6, 7 is essentially constant across its entire width.

Experience has demonstrated, that a multiplicity of elastic materials, which are adaptable for use as a friction ring 2, 6, 7, when longitudinally elongated to different lengths, are correspondingly reduced in their width dimensions. Such a lessening of the width occurs, in this application, especially in proximity to the ends 20, 21 and 60, 61 as well as 70, 71, where the tensile force for the stretching of the ~~said~~ friction ring 2, 6, 7 is applied in order to bring these onto the roll body 10, 12, for example, onto a friction roll 1 which is to have a continuous drive surface. On this account, to compensate for such a loss of width, the untensioned friction ring 2, 6, 7 is provided with a greater width  $b_1$  in those areas close to the ends 20, 21, 60, 61 and 70, 71 than in these areas which are more remote from the ends 20, 21 and 60, 61 as well as 70, 71, where the width is less which are more remote from the ends 20, 21 and 60, 61 as well as 70, 71, (see Fig. 2). The transition from the larger width  $b_1$  to the lesser width  $b_2$  is done

gradually, whereby this transition can be either in a uniform shape or a non-uniform shape.

This is analogous to that which previously was described in reference to the thickness distribution ( $s_3$ ,  $s_4$ ) for the friction ring 2, 6, 7. The continuous run of the width and the difference between the widths  $b_1$  and  $b_2$  of the untensioned friction ring 2, 6, 7 is so constructed, that, in the case of the extended friction ring 2, 6, 7, the said difference in width practically disappears, ~~so that~~. Thereby, the tensioned friction ring 2, 6, 7 exhibits an essentially constant width of the friction ring 2, 6, 7 over its entire length and thus, over the total circumference of the roll body 10, 12.

The presented embodiments can be increased or altered with the use of adhesives on the two open ends of the friction ring 2, 6, 7. The ends, in the case of adhesion, can be somewhat slanted, as compared to the above presented embodiments, in order to achieve a particularly firm and impact resistant connection. The adhesive point can be prepared to allow a rapid mounting and yet attain a specified strength of connection. For a proper positioning of the ends to each other, and a rapid curing, the adhesive can be activated by means of light, UV-light or heat.

It will be appreciated by those skilled in the art that various modifications and variations can be made in the present invention, without departing from the scope of the invention. It is intended that the present invention include such modifications and variations as come within the scope of the appended claims and their equivalents.